

FIGURE 1A

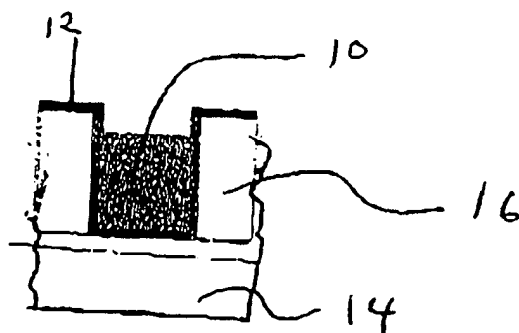


FIGURE 1B

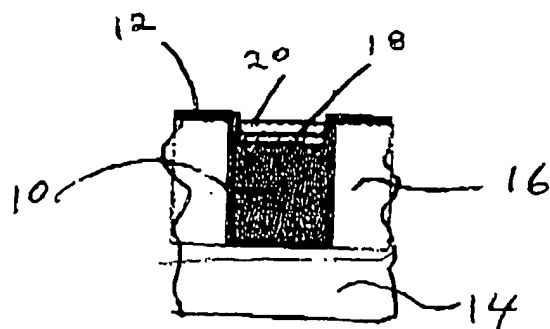


FIGURE 1C

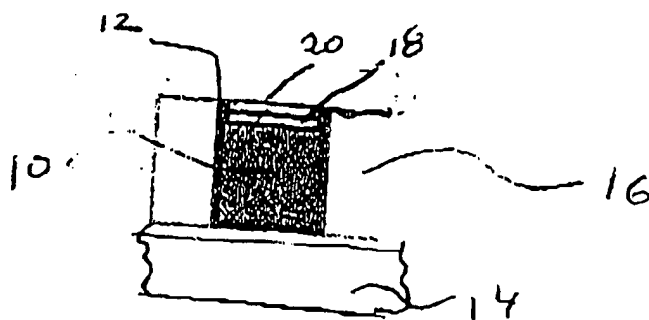


FIGURE 1D

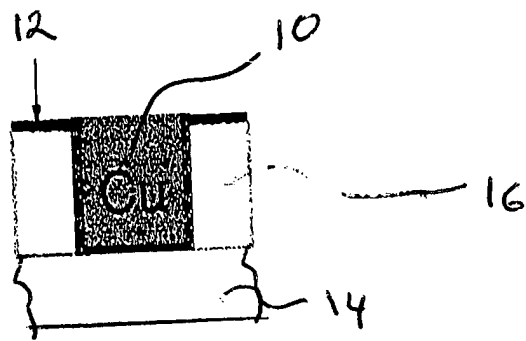


FIGURE 2A

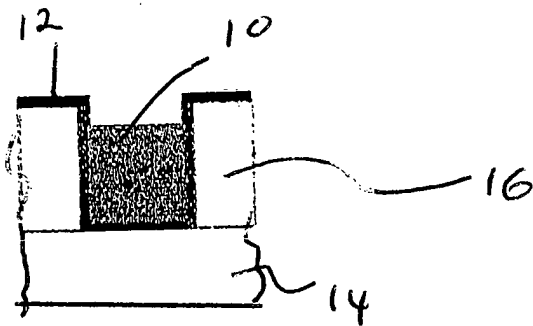


FIGURE 2B

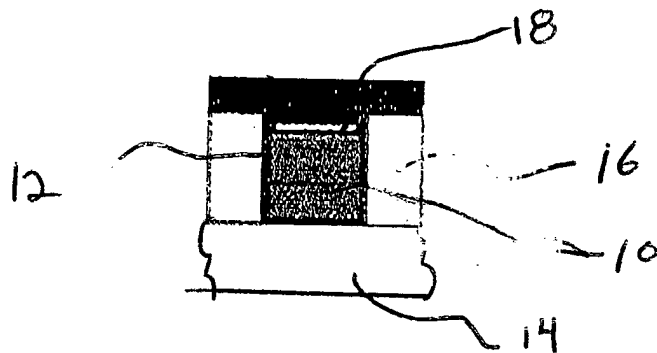


FIGURE 2C

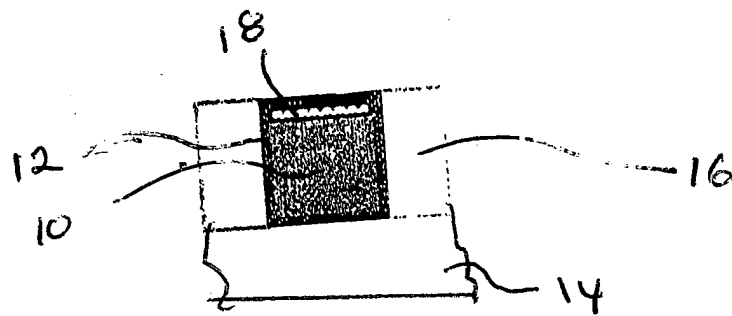


FIGURE 2D

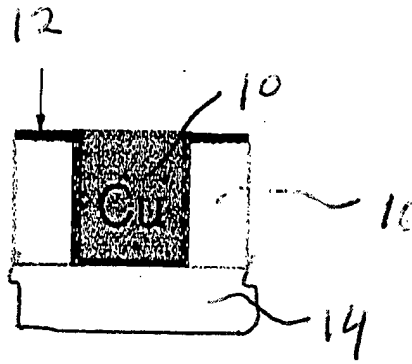


FIGURE 3A

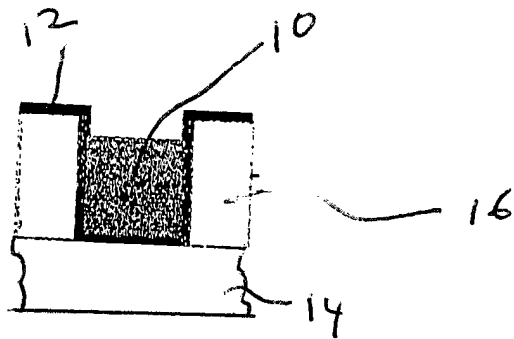


FIGURE 3B

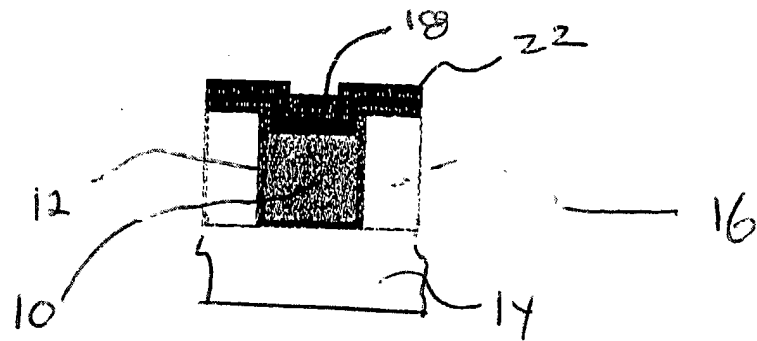


FIGURE 3C

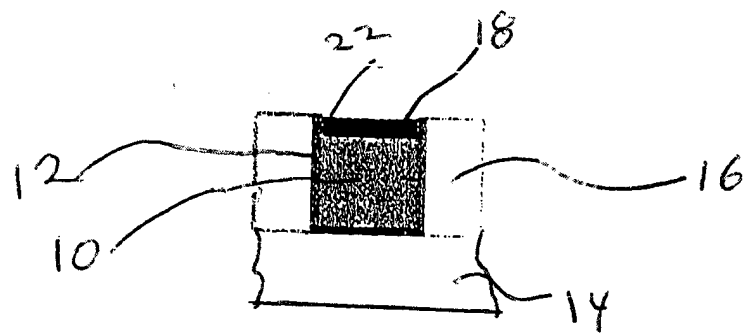


FIGURE 3D

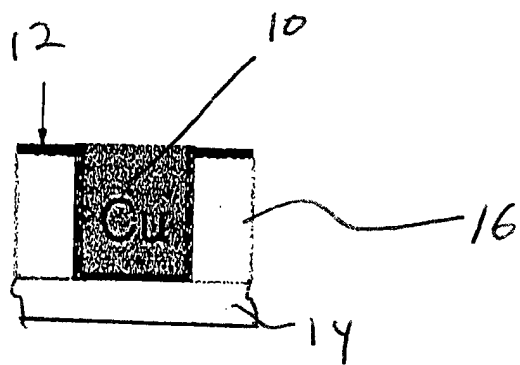


FIGURE 4A

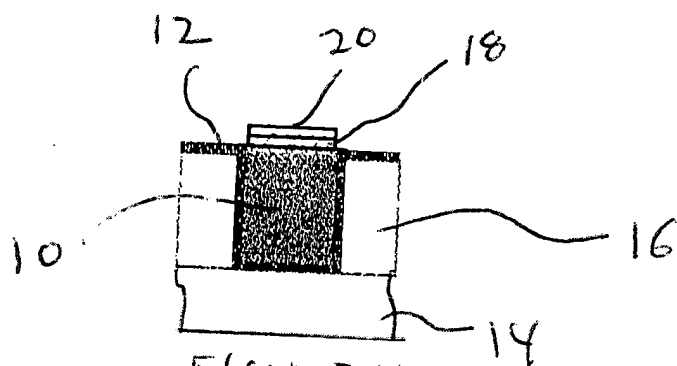


FIGURE 4B

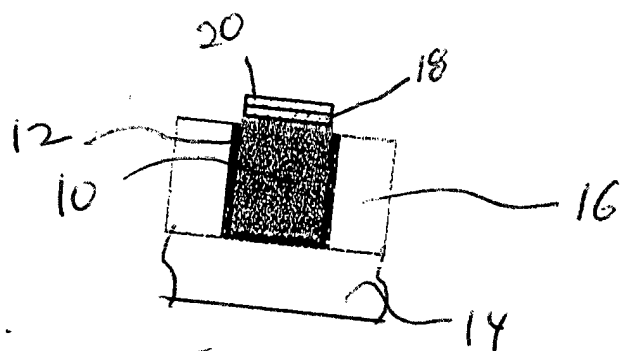


FIGURE 4C

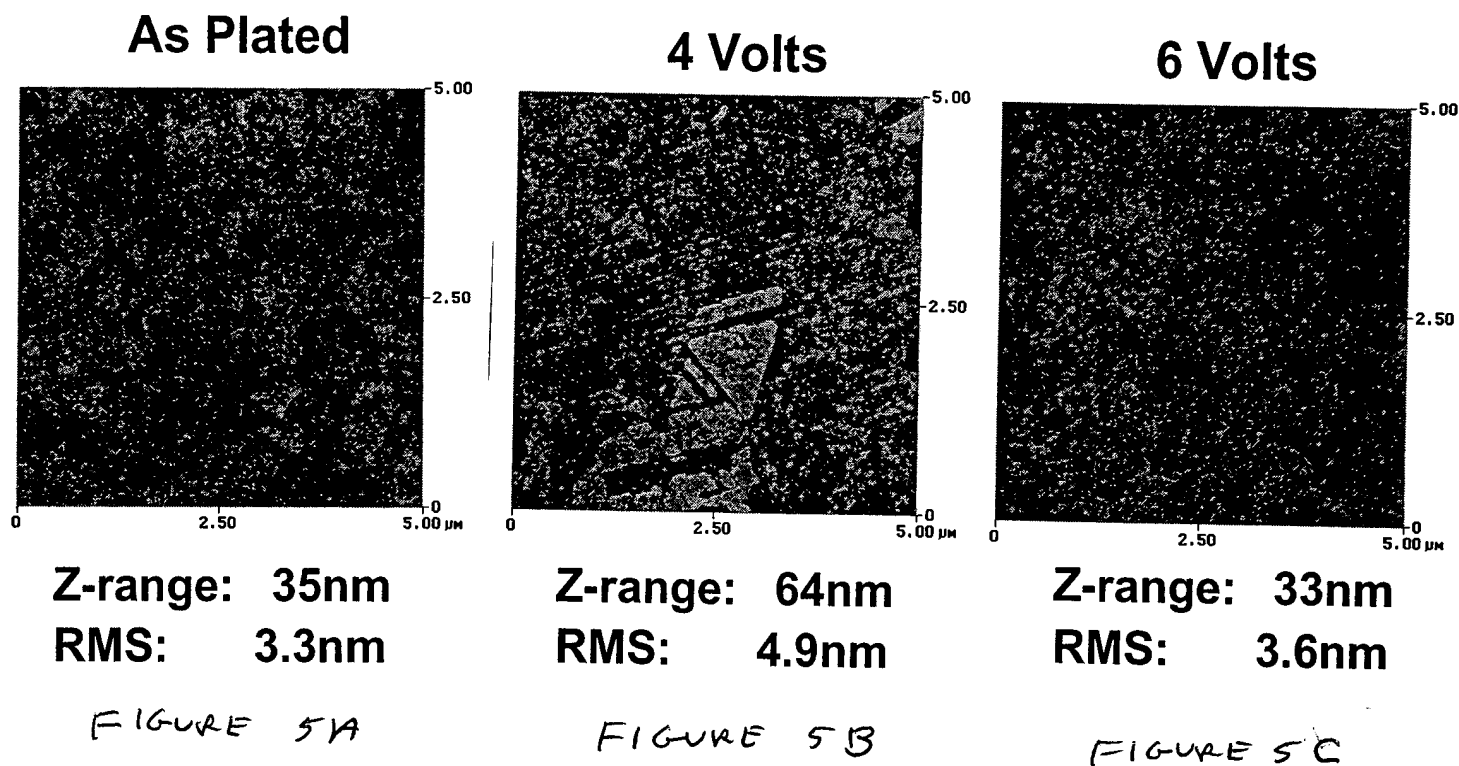
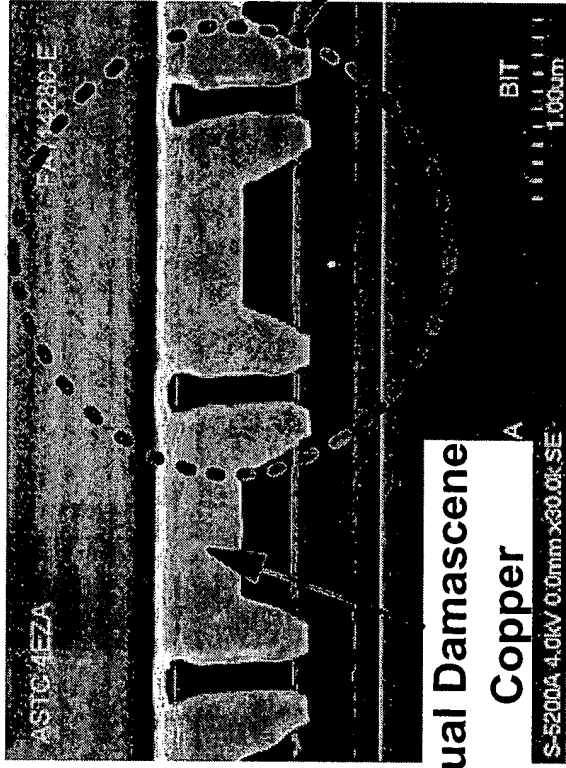


Figure 5 AFM images of Cu in the as-plated condition (left) and electroetched at 4V (middle) and 6V (right); the 6V condition replicates the as-plated features; etching at 4V induces increased roughness probably as the result of crystallographic etching.

Figure 6 SEM cross sections of dual damascene structures with the copper selectively electroetched.



~60 nm

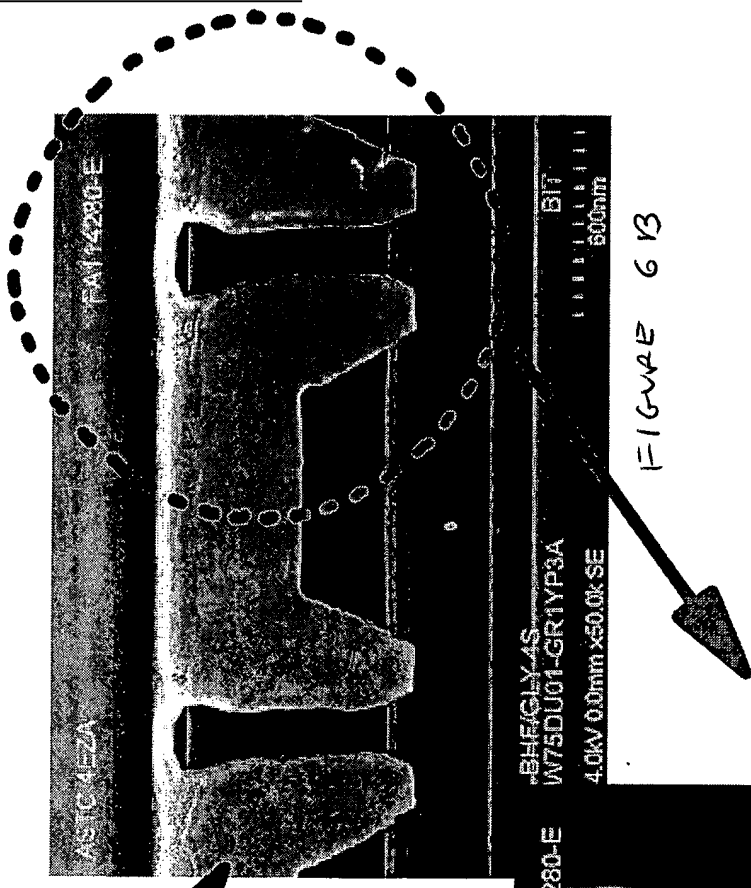
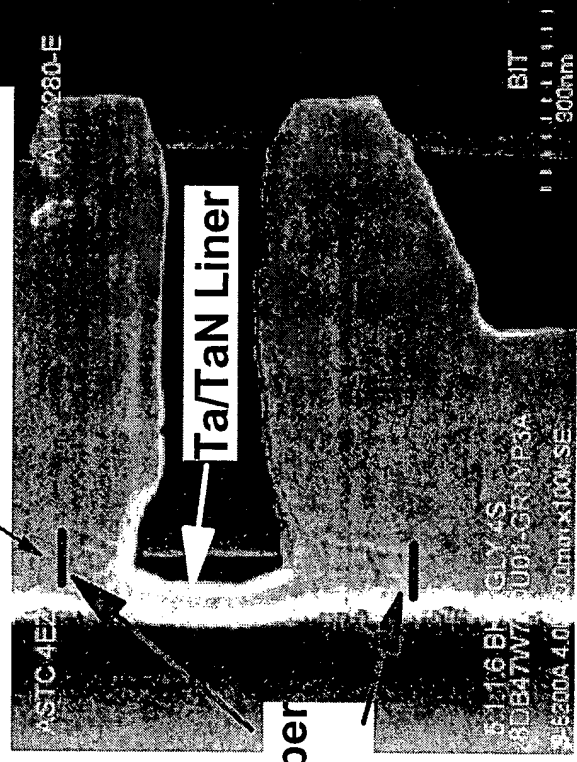


Figure 7. Selectively electroplated Ru (35 nm) inside Cu recess created by selective electropolishing.

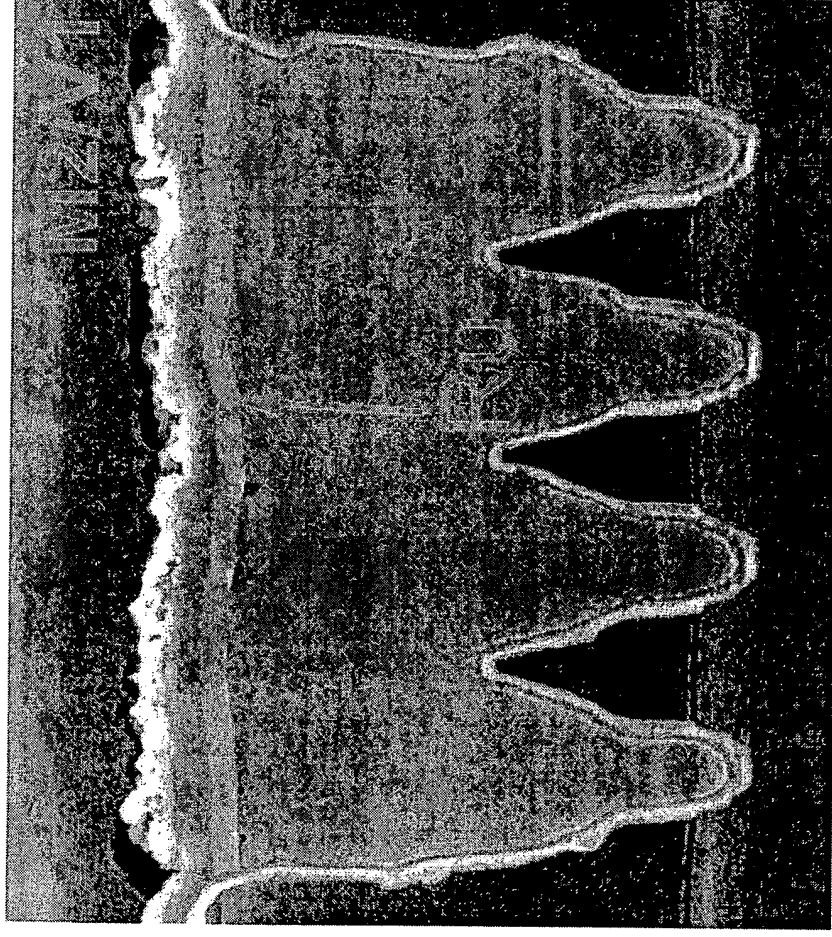


FIGURE 7

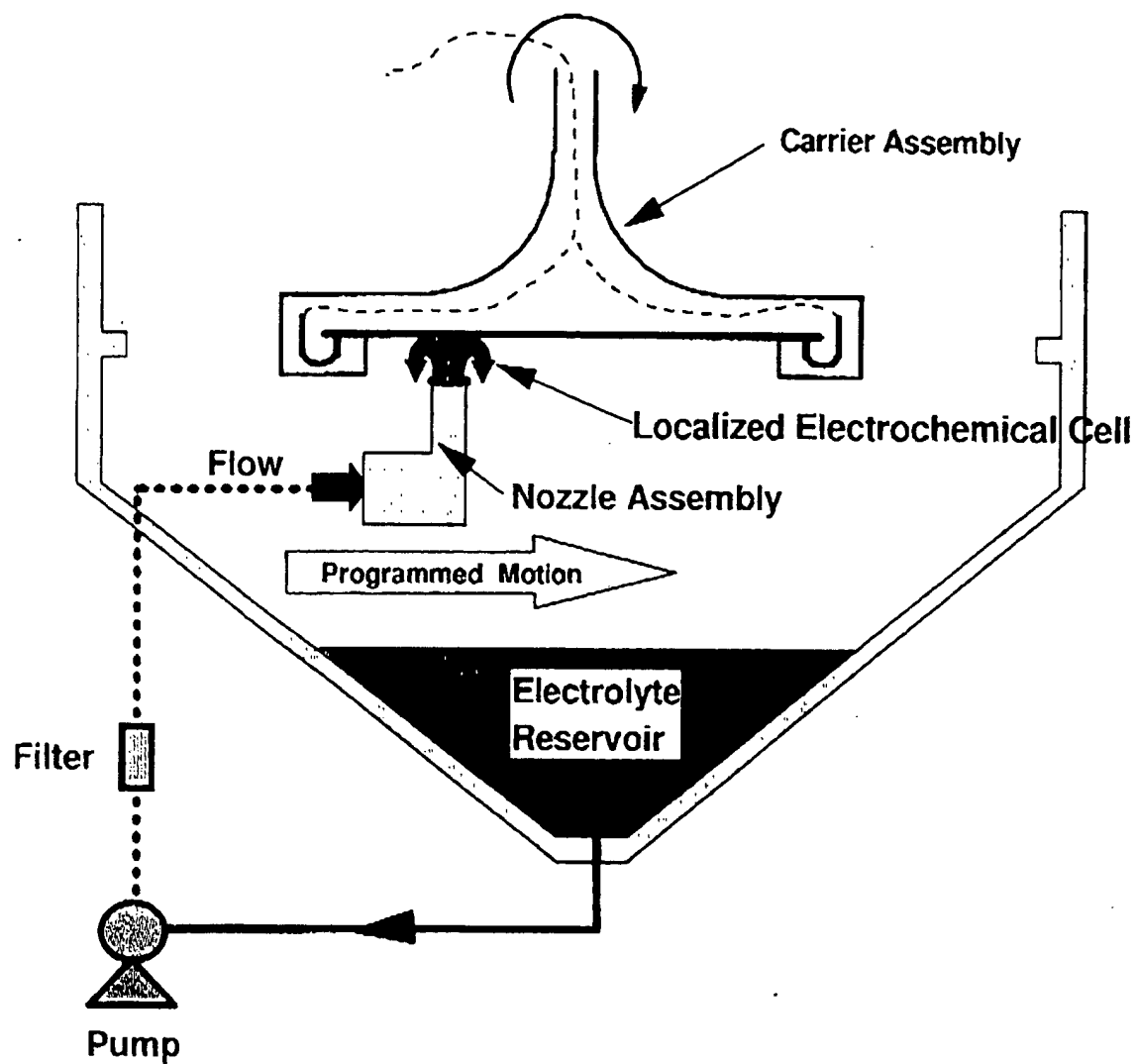


Figure 8 Tool for Cu recess by selective electroetching/etching and for backfill by electrolytic/electroless plating that overcomes the terminal effect by localizing the electrochemistry and by programming of the nozzle motion.

Manifold Electrode

Figure 9a:
Cross section view

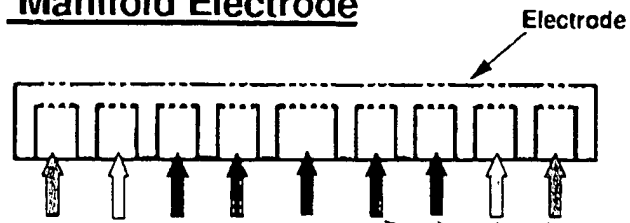


Figure 9b:
Backside view

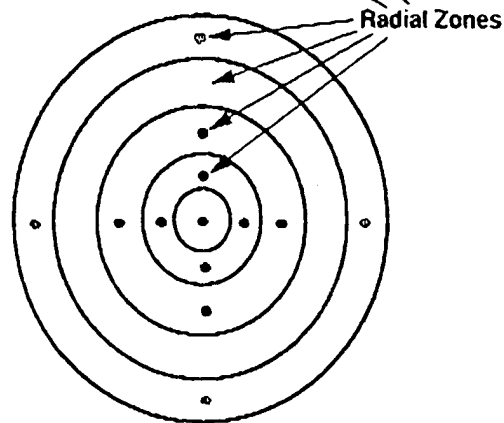


Figure 9c:
Localized Flow Illustration

